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Effects of Nurse-Managed Protocols in the Outpatient Management of Adults with Chronic Conditions

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PREFACE

Quality Enhancement Research Initiative's (QUERI's) Evidence-based Synthesis Program (ESP) was established to provide timely and accurate syntheses of targeted healthcare topics of particular importance to Veterans Affairs (VA) managers and policymakers, as they work to improve the health and healthcare of Veterans. The ESP disseminates these reports throughout VA.

QUERI provides funding for four ESP Centers and each Center has an active VA affiliation. The ESP Centers generate evidence syntheses on important clinical practice topics, and these reports help:

- develop clinical policies informed by evidence,
- guide the implementation of effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures, and
- set the direction for future research to address gaps in clinical knowledge.

In 2009, the ESP Coordinating Center was created to expand the capacity of QUERI Central Office and the four ESP sites by developing and maintaining program processes. In addition, the Center established a Steering Committee comprised of QUERI field-based investigators, VA Patient Care Services, Office of Quality and Performance, and Veterans Integrated Service Networks (VISN) Clinical Management Officers. The Steering Committee provides program oversight, guides strategic planning, coordinates dissemination activities, and develops collaborations with VA leadership to identify new ESP topics of importance to Veterans and the VA healthcare system.

Comments on this evidence report are welcome and can be sent to Nicole Floyd, ESP Coordinating Center Program Manager, at nicole.floyd@va.gov.

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EXECUTIVE SUMMARY

BACKGROUND

Medical management of chronic illness consumes 75 percent of every health care dollar spent in the United States, and the provision of economical, accessible, and high-quality chronic disease care is a continuing concern across health care settings. Type 2 diabetes, hypertension, hyperlipidemia, and congestive heart failure are prime examples of common chronic diseases that cause substantial morbidity and mortality and require long-term medical management and support.

For each of these disease conditions, the majority of care occurs in outpatient settings where well-established clinical practice guidelines can be used to guide treatment decisions. Despite the availability of these guidelines, practice recommendations often are not implemented which contributes to suboptimal clinical outcomes. The shortage of primary care clinicians in outpatient care settings has been identified as a barrier to the provision of comprehensive chronic disease care and provides an impetus to develop and test strategies for expanding the roles and responsibilities of other members of the interdisciplinary team to help meet the continually increasing need for chronic disease care.

In an effort to serve more Veterans and improve the quality and efficiency of chronic disease care, the Department of Veterans Affairs (VA) is implementing Patient Aligned Care Teams (PACTs)—a model of primary care transformation that builds on other widely disseminated efforts such as the chronic care model. VA PACTs are adaptations of the patient-centered medical home, which includes the following core principles: wide-ranging, team-based care; patient-centered orientation toward the whole person; care that is coordinated across all elements of the health care system and the patient's community; enhanced access to care that uses alternative methods of communication; and a systems-based approach to quality and safety. VA PACT clinical teams may include nurses (registered nurses [RNs] or licensed practical nurses [LPNs]) as well as primary care providers, clinical pharmacists, behavioral health specialists, and clinic facilitators. An organizing principle for these care teams is to utilize personnel at the highest level of their skill set. The Institute of Medicine has recommended the expansion of nurses' roles and responsibilities to allow them to practice to the full extent of their education and training.

Reports of the contributions of nurses in improving access and quality of care for patients with selected chronic conditions by using detailed structured protocols developed by or through consultation with physicians began in the late 1960s. There is now robust evidence supporting the effectiveness of nurses in providing patient education about chronic disease treatment, self-care management, and secondary prevention strategies as well as the ability of nurse practitioners (NPs) to provide effective and cost-effective primary care. As the largest segment of the health care workforce, nurses are ideally suited to collaborate with other professionals in meeting the increasing demand for chronic care. Nurses are experienced and accustomed to working in multidisciplinary teams and, with clearly defined clinical protocols and additional training, safely practice beyond their usual scope of practice and may well be able to order relevant diagnostic tests, adjust routine medication regimens, and appropriately refer complicated or unstable patients for further medical evaluation.

The VA is in the process of developing protocols and policies expanding the nurse's role as a member of PACT teams. A protocol contains a series of actions in accordance with current clinical guidelines or standards of practice that are implemented by nurses to manage a patient's condition. At the VA, there is emerging interest in allowing nurses to practice in an expanded role that includes medication initiation or titration under guidelines of protocols. The lack of certainty regarding outcomes associated with the use of clinical protocols by non-NP nurses in expanded roles led the VA to commission this evidence synthesis. We thus synthesized the current literature to describe the effects of nurse-managed protocols for the outpatient management of adults with high-impact, chronic conditions such as type 2 diabetes, hypertension, hyperlipidemia, and congestive heart failure (CHF). We examined the following key questions (KQs):

KQ 1. For adults with chronic medical conditions, do nurse-managed protocols compared with usual care improve the following outcomes?

- Nursing staff experience (e.g., satisfaction)
- Treatment adherence
- Quality measures such as
  - Biophysical markers (e.g., laboratory or physiological markers of health status such as HbA1c and blood pressure)
  - Process-of-care measures used by VA, National Quality Forum, or National Committee for Quality Assurance
- Resource utilization

KQ 2. In studies of nurse-managed protocols, how well do participating nurses adhere to the protocol?

KQ 3. Are there adverse effects associated with the use of nurse-managed protocols?

METHODS

This review was commissioned by the VA's Evidence-based Synthesis Program. We followed a standard protocol for this review; certain methods map to the PRISMA checklist. The topic was nominated after a process that included a preliminary review of published peer-reviewed literature and consultation with investigators, VA and non-VA experts, and key stakeholders (Office of Nursing Services, PACTs, and Primary Care Services).

SEARCH STRATEGY AND STUDY SELECTION

To identify relevant articles, in consultation with a master librarian, we searched MEDLINE® (via PubMed®), Cochrane Central Register of Controlled Trials, Embase®, and CINAHL® from January 1, 1980, to December 12, 2012, for peer-reviewed publications evaluating interventions that used nurse-managed protocols compared with usual care in studies targeting adults with diabetes, hypertension, hyperlipidemia, CHF, or chronic conditions. We limited the search to articles published in the English language involving human subjects 18 years of age and older.

Using prespecified inclusion and exclusion criteria, two reviewers assessed titles and abstracts for relevance to the KQs. Full-text articles identified by either reviewer as potentially relevant

were retrieved for further review and examined by two reviewers against the eligibility criteria. Disagreements on inclusion, exclusion, or the major reason for exclusion were resolved by discussion or by a third reviewer. Key eligibility criteria were randomized controlled trial or quasi-experimental study conducted in an outpatient setting; an RN or LPN used a written protocol to practice beyond their usual scope of practice that included adjustment of medications, to support the longitudinal care for patients with an eligible chronic condition (diabetes, hypertension, hyperlipidemia, or CHF); one or more outcomes of interest reported at ≥ 3 months.

DATA SYNTHESIS

While synthesizing relevant abstracted data, we developed a summary table describing the key outcomes and the types of study designs used to test nurse-managed protocol interventions. We then determined the feasibility of completing a quantitative synthesis (i.e., meta-analysis) to estimate summary effects. Where quantitative synthesis was possible (as for KQ 1), dichotomous outcomes were combined using odds ratios (ORs), and continuous outcomes were combined using mean differences (MDs) in a random-effects model. For studies with unique but conceptually similar outcomes (e.g., ordering a guideline-indicated laboratory test), we synthesized outcomes across conditions if intervention effects were sufficiently homogeneous. As a result, analyses were grouped into two major categories: (1) studies targeting cardiovascular risk factors—hyperglycemia, hypertension, hyperlipidemia and (2) studies targeting CHF.

RISK OF BIAS (QUALITY) AND STRENGTH OF EVIDENCE ASSESSMENT

For RCTs, risk of bias criteria were adequacy of randomization and allocation concealment, the comparability of groups at baseline, blinding, the completeness of followup and differential loss to followup, whether incomplete data were addressed appropriately, the validity of outcome measures, and conflict of interest. For observational studies, we addressed specific issues in the general areas of selection bias, performance bias, detection bias, and reporting bias. We assigned a summary risk of bias score (low, moderate, or high) to individual studies

In addition to rating the quality of individual studies, we evaluated the overall strength of evidence for each KQ as described in the Agency for Healthcare Research and Quality's (AHRQ's) "Methods Guide for Effectiveness and Comparative Effectiveness Reviews." In brief, this approach requires assessment of four domains: risk of bias, consistency, directness, and precision. Additional domains considered were impact of plausible confounders and publication bias. These domains were considered qualitatively, and a summary rating of high, moderate, low, very low, or insufficient strength of evidence was assigned after discussion by two reviewers.

PEER REVIEW

A draft version of the report was reviewed by technical experts and clinical leadership. A transcript of their comments can be found in Appendix E, which elucidates how each comment was considered in the final report.

RESULTS

Our literature search identified 2685 unique citations from a combined search of MEDLINE via PubMed, CINAHL, Embase, the Cochrane Database of Systematic Reviews, and bibliographies of key articles. After applying inclusion and exclusion criteria at both title-and-abstract and full-text review levels, the final set of articles used in this evidence report consisted of 31 articles (represented by 29 unique studies plus 2 companion articles). Of these, 18 focused on management of patients with elevated cardiovascular risk (diabetes mellitus, hypertension, or hyperlipidemia), 10 focused on management of patients with congestive heart failure (CHF), and 1 focused on resource utilization of older adults with chronic conditions. Twenty-six studies were RCTs and all compared the intervention to usual care. The overall risk of bias ratings for individual studies was: low (n=10), moderate (n=16) and high (n=3). No studies were conducted in VA settings.

All 29 studies required the nurse to have the autonomy to titrate medications; 20 of these studies allowed the nurse to independently initiate a new medication. All 29 studies used a protocol to guide the nurses, but for most studies, the protocol was limited to an algorithm describing medication titration. Only one study explicitly described the scope of practice and interactions with the team physician. All studies used an RN or equivalent as the interventionist; no studies reported the use of LPNs.

KQ 1: For adults with chronic medical conditions, do nurse-managed protocols compared with usual care improve the following outcomes?

- Nursing staff experience (e.g., satisfaction)
- Treatment adherence
- Quality measures
- Resource utilization

Key Points

- For patients with elevated cardiovascular risk, interventions using nurse-managed protocols had an overall positive effect on improving HbA1c, blood pressure, and hyperlipidemia, but effects varied substantially across studies.
- Nurse-managed protocols using an RN compared with usual care also were associated with more patients reaching target goals in total cholesterol and blood pressure.
- For patients with CHF, nurse-managed protocols using an RN were associated with lower all-cause mortality, more patients being prescribed an angiotensin-converting enzyme inhibitor or angiotensin receptor blocking (ACE/ARB) agent, and decreased CHF-related hospitalizations compared with usual care.
- Effects on nursing staff satisfaction were not reported.
- Effects on treatment adherence were reported infrequently but showed a pattern of improved adherence to lifestyle goals.
- The educational preparation needed to assume this expanded nurse role was not well reported.

The most robust finding is that nurse-managed protocols had a positive impact on the biophysical outcomes of chronically ill patients (Table 1). Among the studies targeting elevated cardiovascular risk, HbA1c improved by approximately 0.4 percentage points (moderate strength of evidence [SOE]); systolic and diastolic blood pressure improved by 4 mmHg and 2 mmHg, respectively (moderate SOE); total cholesterol improved by 9 mmol/l, and LDL improved by 12 mmol/l (low SOE). Among the CHF studies, nurse-managed care resulted in a significant decrease in mortality (OR 0.71; 95% CI, 0.52 to 0.96) and fewer CHF-related hospitalizations (OR 0.62; 95% CI, 0.49 to 0.80; high SOE). For both patient groups, nurse-managed protocols also were more likely to achieve target goals for markers of disease severity (e.g., lipid values) or medication-prescribing goals (moderate SOE).

Subgroup analyses showed some differences between in-person and telephone-based care studies, non-U.S. and U.S.-based studies, and among studies that incorporated self-management plans or specific behavioral interventions. Interventions delivered primarily by telephone showed significantly greater effects for total and LDL cholesterol in patients with elevated cardiovascular risk and greater mortality reductions in patients with CHF. There was a similar pattern for other outcomes but these were not statistically significant. These exploratory analyses suggest that telephone-based care may be a promising delivery mode for implementing nurse-managed protocols. Other subgroup analyses did not show any consistent pattern across outcomes.

Patient treatment adherence was reported in 6 studies, and medication adherence was reported in only 1. Effects of nurse-managed protocols on lifestyle changes and medication adherence were reported infrequently, but when reported showed an overall pattern of small positive effects (low SOE). The strength of evidence was insufficient to estimate a treatment effect for all other outcomes: nurse satisfaction, health-related quality of life, and health care costs.

Table 1. Summary of the strength of evidence for KQ 1

Outcome	Number of Studies (Patients)	Effect Estimate (95% CI)	SOE
Nurse-managed protocol intervention vs. usual care—cardiovascular risk studies			
Hemoblogin A1c	8 (2633)	MD = -0.40 (-0.63 to -0.17)	Moderate
Systolic blood pressure	12 (10,224)	MD = -3.68 (-5.67 to -1.69)	Moderate
Diastolic blood pressure	12 (10,224)	MD = -1.56 (-2.57 to -0.55)	Moderate
Blood pressure at goal	10 (9707)	OR = 1.41 (1.12 to 1.78) RD = 77 more per 1000 patients (24 to 133 more)	Moderate
Total cholesterol	9 (3494)	MD = -9.37 (-17.87 to -0.87)	Low
LDL cholesterol	6 (1119)	MD = -12.07 (-24.10 to -0.03)	Low
Cholesterol at goal	11 (9221)	OR = 1.54 (1.14 to 2.08) RD = 106 more per 1000 patients (33 to 174 more)	Moderate
Nurse-managed protocol intervention vs. usual care—congestive heart failure studies			
Mortality	10 (2836)	OR = 0.71 (0.52 to 0.96) RD = 36 fewer per 1000 patients (5 to 62 fewer)	Moderate
Total hospitalizations	6 (2352)	OR = 0.83 (0.62 to 1.10) No significant difference: RD = 32 fewer per 1000 patients (76 fewer to 18 more)	Low

Outcome	Number of Studies (Patients)	Effect Estimate (95% CI)	SOE
CHF-related hospitalizations	5 (2231)	OR = 0.62 (0.49 to 0.80) RD = 42 fewer per 1000 patients (22 to 57 fewer)	High
ACE/ARB prescribed	6 (2050)	OR = 1.15 (0.90 to 1.46) No significant difference: RD = 18 more per 1000 patients (15 fewer to 45 more)	Moderate

Abbreviations: ACE=angiotensin-converting enzyme inhibitor; ARB=angiotensin receptor blocker; CHF=congestive heart failure; CI=confidence interval; LDL=low-density lipoprotein; MD=mean difference; OR=odds ratio; RCT=randomized controlled trial; RD=risk difference; RR=risk ratio; SOE=strength of evidence

KQ 2: In studies of nurse-managed protocols, how well do participating nurses adhere to the protocol?

Key Points

- Indirect evidence (e.g., improved outcomes) suggests that nurses adhere to protocols, but direct evidence (e.g., through fidelity checks) is insufficient to establish how well nurses adhere to protocols when engaged in delivering nurse-managed care.
- Only two of 29 included studies reported direct nurse adherence to treatment protocols.

Although no studies reported fidelity to important elements of the treatment protocol, indirect evidence (e.g., improved outcomes) suggests reasonable adherence to the medication elements of the protocol. Results from increased ACE/ARB treatment goals suggest nurses used the protocols. Two studies reported data on adherence to treatment protocols. When compared with usual care, nurses instituted pharmacological therapy for lipid management more often. One study reported that hypoglycemic agents and antihypertensives including ACE inhibitors, angiotensin 2 antagonists, and statins were started or doses increased by nurses following treatment protocols compared with usual care groups. However, there was no report of overall fidelity to the protocols (e.g., levels of titration, consultation with a supervisor). Thus, the data is insufficient to establish how well nurses adhere to protocols when engaged in delivering nurse-managed care.

KQ 3: Are there adverse effects associated with the use of nurse-managed protocols?

Key Points

- Adverse events were reported in only one study.
- Evidence was insufficient to establish if there are adverse effects associated with the use of nurse-managed protocols.

There was a paucity of reported adverse events in the included studies (for details on mortality, refer to section above). Adverse events include, for example, hypoglycemic or syncope episodes due to medication titration, wrong medications or dosage prescribed, drug-to-drug interactions, or increased rates of injury such as falls. Only one fair-quality U.S. study on diabetes in a health maintenance organization reported on adverse events. Severe low blood glucose events were identical (1.5%) at baseline and increased similarly, 2.9% in the control group compared with 3.1% in the intervention group (p=0.158). Death did not occur in either group.

RECOMMENDATIONS FOR FUTURE RESEARCH

We used the framework recommended by Robinson et al. to identify gaps in evidence and classify why these gaps exist (Table 2). This approach considers PICOTS (population, intervention, comparator, outcomes, timing, and setting) to identify gaps and classifies them as due to (1) insufficient or imprecise information, (2) biased information, (3) inconsistency or unknown consistency, and (4) not the right information. VA and other health care systems should consider their clinical and policy needs when deciding whether to invest in research to address gaps in evidence.

Table 2. Evidence gaps and future research

Evidence Gap	Reason	Type of Studies to Consider
Patients		
Effects in patients with complex disease or multiple chronic conditions	Insufficient information	Single and multisite RCTs Quasi-experimental studies
Interventions		
Uncertainty about effects of narrowly focused (e.g., blood pressure) or multitarget (e.g., HbA1c, blood pressure, and lipids) interventions.	Insufficient information Exploratory analysis suggest possible differential effect	RCTs or quasi-experimental studies of focused versus multitarget interventions
Interventions described in sufficient detail for replication	Insufficient information	Qualitative evaluation of nurse-managed protocols to address implementation needs of stakeholders
Uncertain level of training and supervision needed	Insufficient information	Job-skills analysis Survey of authors and nurse who have evaluated nurse-managed protocols
Outcomes		
Uncertain effects on patient and staff satisfaction and experience	Insufficient information	Nonrandomized or cluster randomized, multisite implementation studies, qualitative studies
Uncertain effects on adverse events	Insufficient information	Multisite observational studies
Uncertain effects on health system costs	Insufficient information	Costs analyses, particularly in patient group with elevated CV risk
Fidelity to the intervention protocol	Insufficient information	Quantitative and qualitative approaches as part of RCT or non-RCT trials or implementation studies
Uncertain whether there would be unintended consequences to other aspects of the health care system if nurse-managed protocols were implemented	Insufficient information	Multisite observational studies

Abbreviation: HbA1c= glycosylated hemoglobin; RCT = randomized controlled trial

Our review shows that nurse-managed protocols help to improve health outcomes among patients with moderate severity of diabetes, hypertension, hyperlipidemia, and CHF. Overall, studies targeted patients with mild to moderate symptom severity. Thus, further research is needed to understand the effects of nurse-managed protocols in complex or unstable patients.

CONCLUSION

There is a pressing need to improve the medical management of adults with chronic disease, and our findings from this review of 29 studies justify testing nurse-managed protocols in the VA where detailed intervention components are monitored and data are collected. While there are many patient-level barriers that impede optimal treatment outcomes, the shortage of primary care clinicians in outpatient settings provides compelling justification to develop and test new models of chronic disease care. With the implementation of PACTs, the VA will play a critical role in reconfiguring team-based care models to expand the responsibilities of team members such as nurses to practice to the full extent of their education and training in order to improve outcomes for patients with chronic diseases.

As the largest health care workforce group, nurses are in an ideal position to collaborate with other team members in the delivery of more accessible and effective chronic disease medical care. Results from this systematic review and meta-analysis suggest that nurse-managed protocols have positive effects on the outpatient management of adults with stable, common chronic conditions such as type 2 diabetes, hypertension, hyperlipidemia, and CHF.

ABBREVIATIONS TABLE

ACE	angiotensin-converting enzyme
AHRQ	Agency for Healthcare Research and Quality
ARB	angiotensin receptor blocking
CHF	congestive heart failure
CI	confidence interval
HbA1c	glycosylated hemoglobin
KQ	key question
LDL	low-density lipoprotein
LPN	licensed practical nurse
NA	not applicable
NP	nurse practitioner
NR	not reported
OR	odds ratio
PACT	Patient Aligned Care Team
RCT	randomized controlled trial
RD	risk difference
RN	registered nurse
RR	risk ratio
SOE	strength of evidence
VA	Department of Veterans Affairs
VHA	Veterans Health Administration

Addendum to "Effects of Nurse-Managed Protocols in the Outpatient Management of Adults with Chronic Conditions: A Systematic Review and Meta-analysis"

Reanalysis of CVD-related Data

Prepared by Jennifer McDuffie, Andrzej Kosinski, Ryan Shaw, John Williams

Our report, "Effects of Nurse-Managed Protocols in the Outpatient Management of Adults with Chronic Conditions: A Systematic Review and Meta-analysis," was submitted to the Annals of Internal Medicine for publication.

After this report was completed and published, the statistical reviewer for a journal submission requested that we reanalyze the data using a statistical approach that accounted for small numbers of studies.

In response to this recommendation, we reanalyzed the data using the Knapp and Hartung (2003) method to adjust the standard errors of the estimated coefficients to help to account for the uncertainty in the estimate of the amount of (residual) heterogeneity. As expected, this analyses did not change any of the point estimates , but 95% confidence intervals increased for some of the outcomes. The original summary estimates of effect and the revised estimates of effect are summarized in the table below.

Table of original vs. revised Confidence Intervals

Statistic (direction of comparison: RNP vs. UC)	Original summary estimates (95% CI)	Revised summary estimates (95% CI_
Mean difference in HbA1c (non-RCTs)	-0.40 (-0.63 to -0.17) -1.12 (-2.99 to 0.74)	-0.40 (-0.70 to -0.10)
Mean difference in SBP	-3.68 (-5.67 to -1.69)	-3.68 (-6.31 to -1.05)
Mean difference in DBP	-1.56 (-2.57 to -0.55)	-1.56 (-2.76 to -0.36)
Achieve target BP values vs. controls (OR)	1.41 (1.21 to 1.78)	1.41 (0.98 to 2.02)
Mean difference in total cholesterol (mmol/L)	-0.24 (-0.46 to 0.02)	-0.24 (-0.54 to 0.05)
Mean difference in low-density-lipoprotein cholesterol	-0.31 (-0.62 to 0.00)	-0.31 (-0.73 to 0.11)
Achieve target TC values vs. controls (OR)	1.54 (1.14 to 2.08)	1.54 (1.02 to 2.31)

OR = Odds ratio

Reference: Knapp, G. & Hartung, J. (2003). Improved tests for a random effects meta-regression with a single covariate. Statistics in Medicine, 22, 2693–2710.